

**REMARKS/ARGUMENTS**

This paper is responsive to the Office Action dated 21 October 2008 wherein claims 1-15 were rejected. By the present amendment, the following claims are currently amended: 1, 3, 5-6, 8-10 and 14; the following claims are original: 4 and 15 ; the following claim is cancelled: 2, 7 and 11-13. Therefore, claims 1, 3-6, 8-10 and 14-15 are pending in the case.

In view of the following remarks, Applicant requests further examination and reconsideration of the present patent application.

**Objections to Disclosure**

The Official Action has objected to the disclosure on several grounds of informality. In particular, at specification page 6, Paragraph [0030], the recitation of "100,00" was said to be erroneous and was required to be changed to - 100,000 -.

The Examiner is thanked for pointing out this inadvertent, obvious error. Indeed, the recitation of "100,00" was an inadvertent error, which obviously is meant to refer to the value of "100,000". By the present amendment to Paragraph [0030], this has been corrected. No new matter is added by this change, since the person of ordinary skill in the art would immediately understand that "100,000" was intended by the original recitation.

The Official Action has pointed out an informality in Paragraphs [0057] and [0058]: values for "n" and "y" are not explicitly stated, and the Action has requested that they be included. These values "n" and "y" indicate the number of repeating units for phosphono functional group repeating units "B", and non-phosphonate repeating units "F", respectively.

In response to this objection, amended Paragraphs [0057] and [0058] are presented. In Paragraph [0057], the following sentence is added: "The value of n is selected such that the Mw of the polymer ranges from about 500 to 50,000". This defines the value of "n" functionally, by the number of repeating units necessary to give the molecular weight in the specified range. There is no new matter added here,

because the specified molecular weight range for phosphonate polymer (I) is already given in original Paragraph [0030], and because any person of ordinary skill in the art would clearly understand how to calculate the number of repeating units from the molecular weight. Thus, in this manner, it is believed that the value for "n" is implicitly stated or understood, and the Examiner is asked to withdraw the objection.

In Paragraph [0058], the following sentences are added: "As noted above, the molar ratio of repeat units B:F may fall within the range of 100:0 to 5:95, so that the number ratio of n:y may also fall within the range of 100:0 to 5:95. The values of y and n are selected such that the Mw of the polymer ranges from about 500 to 50,000". No new matter is added by this, since the recitation of "molar ratio of repeat units B:F" is already given in original Paragraph [0023], and range for Mw is already given at original paragraph [0030]. For any person of ordinary skill in the art of polymer chemistry, these values, as well as the information in the remainder of the original specification, provide sufficient information so that one can determine the extent of polymerization (and thus values for "n" and "y") for phosphonate polymer I, whether it is a homopolymer made up of repeating units of "B", or a co-polymer of repeating units of "B" and "F".

It is noted that Applicants have also amended original Paragraph [0022]. The specification consistently notes that polymer segment (or repeating unit) "F" refers to polymer units made up of non-phosphonate containing monomers. However, one instance in Paragraph [0022] inadvertently and incorrectly referred to such polymer units made up of non-phosphonate containing monomers, as "B". This has now been corrected. See amended Paragraph [0022]. No new matter is presented in this amendment.

#### Rejections under 35 USC 112

The Examiner has rejected claims 7, 9, and 10 under 35 U.S.C. 112, second paragraph, for being indefinite. In particular, claims 7 and 10 were held as being

incomplete because of an essentiality that the structure include values for "n" and "y", respectively.

This rejection is respectfully traversed. To the extent it may be arguably relevant to the claims presented herein, this rejection is disagreed with, since the subscripts "n" and "y" no longer appear in the claims, thus rendering the rejection to be moot. In particular, newly amended claim 1 now recites the presence of "a phosphono functional polymer I including a repeat unit of the structure" (emphasis added), wherein the structure is shown without subscript "n". This clearly recites the metes and bounds of a claim which is not indefinite, since minimum conditions are present in the claims: a "phosphono functional polymer" must be used, and that polymer must contain at least repeating units of a particular chemical structure (although it may also have other repeating units such as non-phosphonate monomer repeating units "F"). Moreover, the Mw of the polymer is now named in the claims. Thus, the claims particularly and distinctly point out what applicants regard as the invention. The Examiner is asked to withdraw the rejection.

On similar grounds, the rejection is also moot with respect to claim 10 as well, as well as traversed. In claim 10, the structure for non-phosphonate monomer repeating units "F" is shown without subscript "y". This clearly recites the metes and bounds of a claim which is not indefinite, since minimum conditions are present in the claims: a "phosphono functional polymer" must be used which is a copolymer, and that copolymer must contain at least repeating units of particular chemical structure as shown in claim 1, as well as repeating units of non-phosphonate monomer repeating units as shown in claim 10. Thus, the claims particularly and distinctly point out what applicants regard as the invention. The Examiner is asked to withdraw the rejection.

The Official Action has rejected claim 9 for erroneously referring to claim 8. The Examiner is correct in pointing out that claim 9 should not have referred back to its preceding claim, and thus has been corrected to refer to "claim 1". Furthermore, the Official Action noted that "the poly(vinylphosphonic acid) recited in claim 9 does not appear to be included in the structure recited in claim 7". In response to this, it is noted that claim 9 now refers to claim 1, which shows a

structure which does indeed subsume the compound of claim 9 (in claim 1, substituent X can be OH or OM, as supported in original paragraph [0057]). Therefore, it is believed that this rejection has been overcome.

#### Rejections under 35 USC 102

The Official Action has rejected originally presented claims 1-5, 7, 8, and 12 for anticipation by Becker 4,446,028. In the point of view of the Action, this reference discloses a method of inhibiting scale formation in a desalting or desalination system as recited in the instant claims.

This rejection is respectfully traversed. For a rejection under 35 USC 102 to be appropriate, a single reference must show all the features of a given claim. In the present case, there are numerous features of independent claim 1 which are not taught or suggested in Becker '028. For example, these feature not present in the reference include: "method inhibits formation of  $\text{Mg}(\text{OH})_2$  scale on the structural parts of the desalination system"; "without the use of mineral acid doping", and a treatment which comprises "a carboxylate containing polymer II". All of the claims which depend from claim 1 should similarly not be subject to this anticipation rejection. For at least these reasons, it is believed that the rejection using Becker 4,446,028 should be withdrawn.

The Official Action has similarly rejected claims 1-2, 5, 7-8 and 12 as being anticipated by "Becker 4,446,026". It is believed that the examiner has made an inadvertent error, since US Patent 4,446,026 is not a reference to Becker. The Official Action may have meant to refer to US Patent 4446046, and this response to the rejection assumes that the rejection meant to refer to US Patent 4446046.

In like manner to the response to the Section 102 rejection above, there are numerous features of independent claim 1 which are not taught or suggested in Becker '046. For example, these feature not present in the reference include: "method inhibits formation of  $\text{Mg}(\text{OH})_2$  scale on the structural parts of the desalination system"; "without the use of mineral acid doping", and a treatment which comprises "a carboxylate containing polymer II". All of the claims which

depend from claim 1 should similarly not be subject to this anticipation rejection, and for at least these reasons, it is believed that the rejection using Becker 4,446,046 should be withdrawn. Such is respectfully requested.

### Rejections under 35 USC 103

The Official Action has rejected claims 6, 11, and 13-15 as being obvious in the sense of 35 U.S.C. 103(a) in view of either Becker '028 or "Becker (026)", taken further in view of Hodgson et al. 4,204,953 (Hodgson). It is assumed that the Action intended to refer to Becker 4,446,046 (Becker '046) instead of a "Becker (026)".

In the point of view of the Action, the claims (including original independent claim 14) differ from either of the Becker references only in the "addition of a polymaleic acid or anhydride, and the inhibition of magnesium hydroxide scale". However, the Action points to Hodgson to allegedly disclose (see col. 1 line 14 through col. 4 line 56) "that it is known in the art to add polymaleic anhydrides to saline water evaporators to inhibit scale deposition including magnesium hydroxide". The Action concludes that it would have been obvious to add polymaleic anhydride to the teachings of the Becker reference to aid in inhibiting scale deposition including magnesium hydroxide in the desalination system.

This rejection is respectfully traversed. The rejection set forth in the Action does not provide a prima facie case for obviousness; and furthermore, the rejection cannot provide a reasonable expectation for success for the claimed method.

Firstly, claims 1 and 14 now recite the feature: "aqueous salt containing medium comprises magnesium cations and hydroxide anions under conditions in which, in absence of treatment,  $\text{Mg}(\text{OH})_2$  scale would form . . .". In contrast, neither Becker reference has any teaching or suggestion for using a phosphono polymer on a medium which comprises magnesium cations and hydroxide anions under conditions in which, in absence of treatment,  $\text{Mg}(\text{OH})_2$  scale would form. The Becker references simply do not deal with such a medium, nor do they teach one how to solve the problem of formation of this particular type of scale. For example, Becker '046 recites inhibition of calcium sulfate, calcium carbonate and/or calcium

phosphate scale in cooling water systems (at its column 1, lines 40-45), but this is unlike inhibiting magnesium hydroxide scale formation on structural parts in contact with an aqueous salt containing medium in a desalination system. Thus, there is no reason or rationale as to why one would particularly wish to apply the phosphono functional polymers to the specific medium now being claimed, especially in the absence of any likelihood of success for inhibiting that particular type of scale.

The Hodgson reference is discussed at Paragraph [0011] of applicants' original specification and forms no more than the very prior art problem which the present invention seeks to solve. Hodgson teaches a method for inhibiting deposition of scale from saline water onto exchanger surfaces by utilizing a scale inhibiting additive (e.g., poly[maleic acid]) in conjunction with a mineral acid to neutralize part of the bicarbonate alkalinity. See for instance, column 1, lines 37-40 of Hodgson, and all the examples of Hodgson, and all its claims. The requirement in Hodgson to use acid dosing (e.g., with a mineral acid such as sulfuric acid or hydrochloric acid), teaches totally away from the present claim feature: "whereby the method inhibits formation of  $Mg(OH)_2$  scale on the structural parts of the desalination system without the use of mineral acid doping", a feature essentially present in all the claims.

In contrast, (as supported in Paragraphs [0018], [0019], [0045] and [0046], among others) Applicants have found that the claimed combination of phosphono functional polymer I and carboxylate containing polymer II can control scale deposition in desalination operations without the use of acid, such as the mineral acids disclosed in the Hodgson reference and recited in the Background section of the present disclosure.

To put the presently claimed invention into context, it is helpful to have some background of the state of the industry at the time of the invention. One of the more serious issues with converting seawater into drinking water is the high alkalinity present in seawater. Because of the high alkalinity, when converting seawater into drinking water, magnesium hydroxide would precipitate out of the aqueous medium, thereby causing severe scale formation on the structures of the desalination system.

At the time of the presently claimed invention, the primary method to manage this issue was to add mineral acid to the feed water, commonly referred to as “acid doping” or “acid dosing” (See paragraph [0005], as well as col. 1, lines 14-22, of Hodgson) All of the then-known commercially available systems included addition of mineral acid feed water. The primary problems with adding mineral acid, however, includes at least the following: the high cost of the additive, corrosion of the equipment, and prohibitive regulations in some jurisdictions that do not allow addition of acid. It was found that by adding the particular polymer of the presently claimed invention to the aqueous medium, however, was that not only was addition of mineral acid eliminated, but also the formation of magnesium hydroxide scale was rigorously inhibited.

Thus, for all these reasons, the combination of Becker references with Hodgson would not lead to the invention as is now claimed.

The Official Action has also rejected claims 9-10 under section 103 as being unpatentable over either Becker reference taken further in view of Bendiksen et al. 5,087,376.

However, the proposed combination of references does not rise to a prima facie case of obviousness, on many grounds. None of the Becker references or Bendiksen teach the use the carboxylate containing polymer II, and so at least this claim feature is lacking. Neither reference teach a medium which comprises magnesium cations and hydroxide anions under conditions in which, in absence of treatment,  $Mg(OH)_2$  scale would form. More importantly, neither reference is concerned with the particular problem of inhibiting  $Mg(OH)_2$  scale in desalination systems; neither Becker makes mention of this, and Bendiksen seems to merely mention magnesium carbonate scale, possibly in the context of cooling water towers but not in the context of desalination systems.

Therefore, it is respectfully requested that the rejection be withdrawn

**SUMMARY**

For the reasons set out above, Applicant respectfully submits that the application is in condition for allowance. Favorable reconsideration and allowance of the application are, therefore, respectfully requested.

If the Examiner believes that anything further is necessary to place the application in better condition for allowance, the Examiner is asked to contact Applicant's undersigned representative at the telephone number below.

Any additional fees which may be due for the accompanying response are hereby petitioned for, and the Director is authorized to charge such fees as may be required to Deposit Account 090470.

Respectfully submitted,

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